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ABSTRACT

In this study of how children select content to use in producing stories, the information children knew about three problem-solving situations was compared to the information they included in their stories about these situations. Twenty children at each of three age levels (6, 9, and 12 years) were interviewed individually. Within each age group, there were subsets of six skilled and six less-skilled readers as defined by performance on standardized reading achievement tests. During the interview, each child was asked to tell stories about being friendly, getting a dog, and doing chores. After telling the stories, the child was queried about motives, means, obstacles, ways around the obstacles, and real life experiences with regard to each of the story situations. Comparison of the information contained in the stories to information elicited by the queries revealed that the utilization process during story production depended on the nature of the knowledge domain of the story. When the knowledge base was relatively simple and uniform across ages (e.g., getting a dog), skill difference were found in the amount of information utilized and age differences were found at the thematic level. When the knowledge base was more complex and differed across ages (e.g., being friendly), age differences in the utilization process were parallel to the differences in the knowledge base. (JMB)

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Knowledge Children Use in Producing Stories about Problem Solving

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A commonly held view of the understanding process is that comprehension is a constructive process that is heavily dependent on the interaction between the form and content of the event to-be-understood and the comprehender's expectations about the form and content of the event (Paris & Lindauer, 1977; Rumelhart, 1977; Brown, 1975; Brown, Collins & Harris, 1978). When the event to-be-understood is a story, these expectations are derived from the comprehender's prior knowledge regarding both grammatical and semantic well-formedness in stories. Given this type of theoretical analysis, individual differences in comprehension, whether age or skill related, may be attributable to a number of factors. Variation among individuals in how successfully they understand a story may be due to differences in expectations about information relevant to the domain of the story, expectations about the grammatical form of stories and/or to the utilization of this prior knowledge during the comprehension process.

Previous empirical work has focused on describing the grammar of stories and on differences in comprehension as a function of grammatical differences among stories (e.g. Mandler & Johnson, 1977; Stein & Glenn, 1979). For example, developmental changes in expectations of story form have been investigated by examining recall performance for stories that

differ in grammatical complexity. Stories that are well recalled are assumed to match the child's concept of a story. Developmental changes in the child's concept of a story have also been examined using story production tasks (e.g. Botvin & Sutton-Smith, 1977; Applebee, 1978; Glenn & Stein, 1979; Stein, 1979).

The story production process involves the selection of some content and the organization and output of that content in some form. The form of the output reflects knowledge of the grammatical form of stories. However, the form of the story has been shown to be affected by the nature of the information that the child is asked to include in the story: given more complex information to include, children produce more complex story forms (Glenn & Stein, 1979; Stein, 1979). We might expect that more complex content domains will lead to the production of more complex discourse since the individual will probably be selecting more complex information. As in comprehension, variations among individuals may be associated with differences in domain-relevant information, differences in the concept of a well-formed story and/or differences in utilization and selection processes that are involved in production.

Although the narrative a child produces provides information about both his concept of a story and his content knowledge for the domain of the narrative, we know little about the nature of the selection process since we do not know what content the child did not select for inclusion in the story. The research I want to discuss today provides a way to examine the selection process. Children were asked to produce stories but were also asked a series of probe questions about solving problems involving realistic goals. All children included less information in

their stories than they knew about the particular problem solving situation. I will use the term knowledge base to refer to the total set of information that was elicited from the child during the interview. The nature of individual differences in the selection process differed depending on whether the problem solving was in a relatively simple domain, getting a dog, or in a more complex domain, being friendly. The nature of these differences is discussed following a brief outline of the procedures that I used.

A structured interview methodology was used to elicit information about three realistic goal situations: being friendly, getting a dog and doing chores. Twenty children at each of three age levels--6, 9 and 12 were interviewed. Within each age group, there was a subset of six skilled and six less-skilled readers, defined by performance on standardized reading achievement tests. Skilled readers had Stanine scores of 6 or above and less-skilled had Stanine scores of 4 or below. During the interview, each child was asked to produce stories and answer probe questions about Wanting and Not wanting to be friendly, to get a dog and to do chores. This "given" information, a goal, corresponds to one type of motivating state information in a story. As can be seen in the sample script in Table 1, the story consequence was also given: the goal was met. The probe questions focused on other categories of story information. Motives, or reasons for setting the goal, typically occur at the beginning of a story and convey the complication or initiating event information in a story. Means, or attempts, are actions and action sequences that lead to goal attainment and convey information about how the protagonist solves the problem that was set up at the beginning of the story. Obstacles are states or events that

prevent goal attainment. They typically occur as the consequence of an attempt and often lead to additional attempts to meet the goal. The interviews also included the two additional probes shown on the handout, but I will not be discussing those today.

Each child was interviewed individually and sessions lasted approximately 45 minutes. Tape recording were made and later transcribed. Equal numbers of boys and girls were interviewed.

The analysis of the protocol content involved classifying the statements in the children's protocols into a number of plausible categories of knowledge about problem solving that involves realistic goals. The categories are represented as a taxonomy, shown in Table 2. These categories were derived through rational task analysis that began with proposals regarding characteristics of goal directed behavior, proposals that have been made by researchers in social psychology, social cognitive development and cognitive science. In addition, preliminary examination of the statements in the protocols indicated that children described states and actions that referred to the protagonist, i.e. the person who had the goal, to other people, and to aspects of the external environment. This was true for each of the goal situations, although the specific states and actions differed. The categories of information represent knowledge at a frame-like level (cf. Minsky, 1975). Categories are instantiated in the context of a specific goal situation. It is thus possible to compare the knowledge base for different goal situations without sacrificing the unique characteristics of a particular goal situation.

As can be seen in Table 2, there is a primary distinction among aspects of knowledge about the protagonist, about the involvement of other people and about the role of the external environment. Each of

these primary distinctions is further divided into the components shown in Table 2. Rather than go into a lot of detail here, the handout includes descriptions and examples of statements that were scored as reflecting knowledge of particular categories. Instead, I'd like to consider the characteristics of the knowledge base and the utilization of knowledge base information in story production.

The characteristics of the knowledge base were determined by applying the taxonomic categories to information in the stories and in response to the Motive, Means and Obstacle probes. If the information was present in any or all four of these parts of the interview, the child received the same credit. The utilization process was examined by comparing the categories contained in the stories where the goal was met with the knowledge base for that goal situation. Conclusions about individual differences in the utilization process were affected by the characteristics of the knowledge base and whether the knowledge base changed with age. For the Dogs situation, a concrete object goal, there were no developmental differences in the knowledge base. However, for the friendly situation, an abstract interpersonal goal, there were developmental differences in the knowledge base. The nature of these similarities and differences in the knowledge base for the two situations is illustrated in Table 3, which shows the Core categories of information. Core categories were defined as follows: if a particular category of information was included by at least 90% or 18 of the children in a particular age group, that category was identified as Core information for that goal situation. For the Dogs situation, the Core knowledge base for each age group is the same. Core includes specific actions associated with

getting or not getting a dog, the protagonist's feelings about dogs and the role played by parents and family members in the protagonist's problem solution. For the Friendly situation, there are elaborative increases in the Core knowledge base: the older children include everything that is included by the younger children plus additional information. I would like to now illustrate how conclusions about individual differences in the utilization process differ, depending on whether one examines utilization of a relatively simple and concrete domain in which the knowledge base does not change or a more complex and abstract domain in which the knowledge base does change with age.

The utilization process can be described by a quantitative index of how many information categories are used in the stories and by a qualitative index of what kinds of categories are used. Furthermore, developmental and skill differences could be associated with each index. However, in the present context, skill differences were associated only with the quantitative index and only for the stories in the simple domain.

The results of the quantitative analyses are shown in Table 4. First, note that the similarity in the knowledge base for dogs and the differences in the knowledge base for friendly are also illustrated by the number of categories included in the knowledge base. With respect to the utilization of information, in the simpler Dogs situation, there are no age differences in the number of knowledge base categories utilized in the story. However, within each age group, skill differences in utilization are present: Skilled readers include more information than do less-skilled readers. This difference is strongest in the nine year old age group. On the other hand, for the more complex friendly situation, there are no skill differences in utilization. Rather the age differences in the knowledge base are replicated in age

differences in the amount of information included in the stories.

A similar characterization of the utilization process is illustrated by the qualitative analyses of the kinds of information used in the story. All children included a subset of the Core knowledge base in their stories. For the simpler Dogs situation, the subset was similar across ages. The stories produced by each age group consistently included the protagonist's specific actions and the role of parents and family members. For the Friendly situation, age differences in the information in the stories parallel the elaborative trend found in the Core knowledge base: the youngest children consistently included the protagonist's specific actions and the role of the friendship object. The nine year olds added information about being in or getting to a common location and the oldest children added attempts to establish a basis for being friendly.

The fact that only a subset of Core information was consistently included in the stories may, in part, be due to the presence of a thematic constraint on story production. That is, a story must have an identifiable theme. This theme may make certain kinds of information irrelevant in the context of the story even though the information is of central importance in the knowledge base. Furthermore, there is an interesting difference between the themes developed for the more complex domain and those developed for the simpler domain. For the complex friendship domain, the story themes are similar across ages while for the simpler Dogs domain, there are age differences in the story themes. The data are shown in Table 5. Notice that the major story themes for friendship were basically definitions of the concept of friendship and age differences in story

content are thus explained by age differences in the knowledge base for friendship. In contrast, for the Dogs situation, there are age differences in the story themes but not in the knowledge base. The themes of the older children suggest that they are more aware of the requirement that a good story involves some conflict or element of surprise. For example, half of the twelve year old's stories about wanting and getting a dog involve parent-child conflict. This is a more complex version of the conflict-free "ask and you shall receive" theme, the dominant theme for the youngest children. The nine year olds introduced the element of suspense in the form of the birthday present theme, where the child asks for a dog as a present, but then must wait to see if he actually receives what he wants.

A plausible and empirically testable explanation of the differences in the themes for the Dogs and Friendly situations is the following: when a domain is more complex, the process of content selection is more demanding and fewer resources can be allocated to the organization and output of the information. When the domain is relatively simple, it is easier to select content and more resources can be allocated to thematic organization and output form of the information. The process of selecting information from a more complex domain may place limits on the child's ability to construct sophisticated, "interesting" stories. This type of explanation may also apply to the utilization of content knowledge during comprehension. When the child is attempting to comprehend a story about a relatively simple domain and that domain in one where he has already acquired most of the relevant information he may be able to comprehend stories that have complex themes and

grammatical structures. He knows what kinds of information to expect in the story and may be attempting to understand the organization of the information. This type of comprehension task (text) may thus allow the acquisition of knowledge about variations in story forms. The child may also be able to allocate processing resources to higher order comprehension processes, for example, making inferences about character traits and the moral of a story. In contrast, when the child is attempting to comprehend a story in a domain for which he knows only a subset of the content information, story comprehension serves as a mechanism for the acquisition of domain-relevant content information. If this new content information is presented in a complex organization, both the acquisition of content and comprehension of the story may suffer. Acquisition of the content may be more successful when presented in relatively simple form.

In concluding, I would like to stress the fact that conclusions about the utilization process during story production depended on the nature of the knowledge domain of the story. When the knowledge base was relatively simple and uniform across ages, skill differences were found in the amount of information utilized and age differences were found at the thematic level. When the knowledge base was more complex and differed across ages, age differences in the utilization process were parallel to the differences in the knowledge base. Thus, the characteristics of the knowledge base in the domain of the discourse seem to be an important factor to consider in further work on the nature of individual differences in utilization processes.

Handout: Knowledge Children Use in Producing Stories about Problem Solving
Susan R. Goldman, University of California, Santa Barbara.
APA, 1979.

Table 1

Sample Interview Script

Goal situation: Getting a dog

Story about attaining goal:

E: I want you to make up a story today. The story is about you. Suppose one day you decided "I want a dog." Tell me a story about you wanting a dog and getting one.

Motive Probe

E: Why would you want a dog in the first place? What might be a reason for wanting a dog? What might make you want a dog?

Means Probe

E: Now tell me everything you would have to do to get a dog. You told me some things in your story. What else would you do to get a dog?

Obstacle Probe

E: Now let's pretend again. Suppose one day you decided, "I want a dog." This time tell me a story where you want a dog but can't get one. What could stop you from getting a dog? What went wrong so you couldn't get one even thcugh you wanted one?

Way Around Obstacle Probe

E: If that happened (child's obstacle), how could you still get a dog? How could you make that story into a story where you did get a dog?

Real Life Probe

E: Okay, now that was all pretend. Now in Real Life, did you ever want a dog? What happened?

Table 2

A Taxonomy of Semantic Information: Some Plausible Categories of Knowledge about Problem Solving that Involves Realistic Goals

Major Categories and Description	Component Categories and Examples
I. PROTAGONIST'S STATES AND ACTIONS Statements that convey information about the internal states, cognitive actions, verbal actions and direct actions of the protagonist.	A. Physical state--tiredness; sleepiness; hunger; thirst. B. General emotional state--anger; fear; shame; happiness. C. Situational states and ongoing activities--I was watching television; I want to be alone; I have to do homework; I already have a lot of pets. *D. Feelings about the goal or about the anticipated outcome of attaining the goal--I like dogs; So I'll have a friend; I don't like to do chores. *E. Specific actions and skill states for attaining the goal--playing; sweeping; buying; I didn't know what to do.
II. ROLE OF OTHER PEOPLE Statements that refer to the involvement of other people in the problem solving goal situation. Component categories specify classes of other people that children's statements referred to.	A. Role of parents and family members--My dad bought it; I ask mom if I can do my chores; Mom didn't like this kid so I couldn't play with her. B. Role of non-family others--My grandma bought me a dog; My other friends teased me when I played with the new girl; The landlord said no, we couldn't have a dog. *B1. Role of specific goal object (for interpersonal goals), e.g. Friendship object--He didn't share his toys; He didn't like me. C. Influence of societal norms and rules of moral conduct--It's the right thing to do; You shouldn't steal.
III. ROLE OF ENVIRONMENT Statements that refer to the environmental availability and accessibility of resources, including goal objects, goal activities, instruments and locations necessary for the protagonist to attain the goal.	*A. Availability of goal object, or activity--There were no kids around; The store had no dogs; The house was all clean. *B. Availability of instrumental resources--We didn't have enough money for a dog; The broom handle was broken; We couldn't agree on what to do; We decided to play monopoly. *C. Availability of location--We didn't have anywhere to keep a dog; I was locked out of the house so I couldn't do my chores; I couldn't go to the park with the other kids.

* The instantiation of these categories is highly specific to each goal situation. Note also that knowledge of more than one category of semantic information was inferred from some of the example statements.

Table 3

Categories of Information in Core Knowledge Base

Categories in Core Knowledge Base	Age group including		
Dogs situation			
Protagonist's specific actions to attain goal	6	9	12
Protagonist's feelings about dogs or about anticipated outcome of attaining goal	6	9	12
Parent(s) and Family play role	6	9	12
Friendly situation			
Protagonist's specific actions to attain goal	6	9	12
Protagonist's feelings about friendliness, friendship object, or anticipated outcome of attaining goal	6	9	12
Friendship object plays role	6	9	12
Availability of common location		9	12
Availability of basis for friendship			12
Protagonist's situational state			12

Table 4

Comparison of Number of Categories in

Knowledge Base and Number in Story

	Goal Situation			
	Dogs		Friendly	
	Knowledge Base	Story	Knowledge Base	Story
Six year olds	5.4	3.4	6.0	3.3
Skilled	5.7	4.0	5.7	2.8
Less skilled	4.8	2.7	5.7	3.3
Nine year olds	6.1	4.3	7.4	4.9
Skilled	6.7	5.8	7.2	5.5
Less skilled	6.0	3.2	7.2	4.5
Twelve year olds	6.0	3.8	8.5	5.0
Skilled	6.3	4.3	9.5	5.7
Less skilled	5.8	3.5	8.8	5.2

Table 5

Major Themes in the Stories

Theme	Frequency for each age group		
	6	9	12
Wanting to be friendly and being friendly			
1. Meeting a new person and making a new friend	5	4	4
2. Child's reasons for wanting to be friendly	1	2	6
3. Child engages in friendly actions	6	6	9
4. Child convinces someone to be friendly with him	5	4	0
Not wanting to be friendly and not being friendly			
1. Child's reasons for not wanting to be friendly	2	5	10
2. Child engages in actions that are unfriendly	17	11	3
3. Friendship object tries but cannot convince child to be friendly	0	3	7
Want a dog and get one			
1. Parents get one in response to child's request (no conflict)	10	7	4
2. Parent-child conflict over getting but child gets	3	3	10
3. Child gets as a birthday or Christmas present	1	10	4
Not wanting a dog and not getting one			
1. Child requests that parents not get one	4	1	0
2. Child's reasons for not wanting a dog	8	3	5
a. Child wants something else	0	5	3
3. Family member wants one and child convinces them not to get one	5	8	9